INTERNATIONAL PRICE LEVELS AND PURCHASING POWER PARITIES

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INTRODUCTION

The purpose of this paper is to present new information about prices in different OECD countries. The data are derived from the recently completed project to calculate Purchasing Power Parities (PPPs) for the majority of OECD countries in 1980 [see Ward (1985)]. The results show that when prices in different countries are converted into a common currency at market exchange rates average price levels are not the same in all countries. Indeed, the prices of the goods and services which make up final expenditure may on average be up to twice as high in some OECD countries as in others. Similarly, there are important differences in the patterns of relative prices in different countries, as the prices of services, including government services, may be up to twice as high *relatively* to the prices of goods in some OECD countries as in others. The substantial price differences observed among different OECD countries are presented in this paper, which also investigates how they are related to differences in real per capita GDP. The results reflect the fact that PPPs, at least for final expenditures, are generally not the same as market exchange rates, and that the two diverge systematically for pairs of countries with different levels of real per capita GDP.

I. BACKGROUND DATA AND METHODS

The prices and volumes of goods and services sold in different countries can be compared in the same way that prices and volumes in different periods of time are compared in order to measure inflation and real growth within a single country. The method applied in international comparisons is that generally used in intertemporal comparisons, namely to collect price data directly and then to use the resulting price indices to deflate the values of the corresponding aggregate expenditures to obtain the volume measures. The fact that the prices in different countries are denominated in different currencies is no problem: it simply affects the dimensions of the price measures which ensue. Whether comparing prices over time within the same country, or between countries within the same period of time, the procedure is basically the same: namely, to specify a precise set of goods and services whose prices have to be collected in both situations, to calculate the ensuing price ratios or relatives, and then to average the price ratios to arrive at an overall index.

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The similarity between international and intertemporal price comparisons may be illustrated by the following simple examples. The price index (or deflator) of GDP for the United States in **1983** was **122** based on **1980** equals one hundred. This means that, on *average,* one dollar and twenty-two cents were needed in the United States in **1983** to buy the same bundle of final goods and services as one dollar could buy in **1980.** Similarly, the PPP for the GDP of France based on that of the United States in **1980** was **5.24** French Francs per US dollar, i.e., on *average,* **5.24** French Francs were needed in France in **1980** to buy the same bundle of final goods and services as one dollar would buy in the United States in **1980.** Thus, a PPP has the same meaning as an intertemporal price index and shows how many units of currency are needed in one situation to buy the same quantity of goods and services as one unit of currency buys in the other situation. There are, of course, traditional index number problems involved in such calculations, but in principle these are the same for international comparisons as for the more familiar intertemporal comparisons.

An alternative method of comparing price levels between countries would be to use the spot exchange rate to convert all the prices in one country into the currency of the other before calculating the international price index. The resulting index would then closely resemble a conventional intertemporal price index as it would be a pure number devoid of currency units. Of course, dividing all the prices in one country by the exchange rate is a simple scalar transformation which merely changes the dimensions, or units, in which the resulting index is expressed without affecting the underlying price comparison. In this form, however, the index can be interpreted as showing by how much the purchasing power of a currency differs between two countries at the going exchange rate. Such indices are presented below where they are described as "international price indices" in order to distinguish them from PPPs.

Price indices vary according to the coverage of the set of goods and services to which they refer: each set of goods and services has its own index. This variation tends to be more pronounced in international than intertemporal comparisons because patterns of relative prices tend to differ much more from one country to another than from one year to the next within the same country. For a given pair of countries, PPPs, or international price indices, can vary quite substantially even between broad aggregates — for example, between goods and services, or between consumption and investment. One of the main purposes of this paper will be to pinpoint such differences and analyse some of their implications. Given these differences in relative prices the structure of final expenditures — for example, the shares of capital formation or government expenditure in GDP — can be significantly changed when all expenditures are revalued at a set of constant international prices for purposes of international comparisons.

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The basic price and expenditure data obtained from the **1980** OECD PPP project are presented in a summary form in the next section. The way in which the data were calculated has been explained in detail elsewhere [Ward **(1985)**] and the methodology used is only summarised here. It should be noted that the PPPs for the twelve Member countries of the EEC were actually calculated by the Statistical Office of the European Communities (or Eurostat) and were incorporated en bloc without change into the OECD project [see Eurostat **(1983)** for a detailed description of the EEC programme]. The OECD gratefully acknowledges the major contribution which Eurostat has made to its own programme. In fact, the OECD entered the project at a late stage and was obliged to collect data for the major non-European OECD countries, i.e. the United States, Canada and Japan, retrospectively. This inevitably restricted the availability of the data to some extent and may possibly have detracted from the quality of the results for some categories of expenditure.

The results for the years **1981** to **1984** presented in this paper have been obtained by extrapolating the bench-mark PPPs for **1980** on the basis of the relative rates of inflation in the different countries covered for the categories of expenditure in question. While this procedure may be expected to give quite reliable results from one year to the next, over a period of several years it is possible that the errors may cumulate. Thus, the results for the most recent years quoted, **1983** and **1984,** must be treated with some caution. Finally, it should be noted that the OECD is now engaged in a major new programme to calculate PPPs for **1985** for almost all its Member countries in collaboration with Eurostat. It is expected that both the quantity and quality of the basic price data will be significantly improved for certain countries. It is possible that the results from the **1985** programme, which will be available early in **1987,** may lead to some significant revisions to the estimates for recent years obtained by extrapolating from **1980.**

II.   PPPS AND REAL EXPENDITURES IN **1980**

It is convenient to start by summarising the results obtained from the **1980** PPP project for the main components of final expenditure. The underlying methodology is to use the basic price information collected in individual countries to estimate average international prices for the group of countries as a whole, which means, in effect, average OECD prices in the present context. For convenience, these average international prices are denominated in US dollars. The goods and services which enter into final expenditures in each country are then revalued at

these international prices and the resulting real expenditures, expressed per head of population, are shown in Table **1.**

Although the calculations underlying the data in Table **1** are complex, the results are easy to understand and interpret. The data are, in effect, "constant price" data of the kind which are typically found in national accounts publications in order to show "real" changes in expenditures over time. The only difference is that the constant prices do not refer to any single country, but to the average **1980** prices within the group of countries as a whole. These average international prices have to be expressed in some currency unit and, in principle, any currency, or basket of currencies, could serve as the numeraire. In practice, the US dollar has been used and the value of the international dollar (**i.e.** the numeraire) has been fixed by ensuring that the value of total US GDP expressed in international dollars is equal to its **1980** value in actual US dollars.

The domestic final expenditures which make up GDP have been consolidated in Table **1** and subsequent tables in order to focus on the distinction between goods and services. Within goods and services, consumer goods and capital goods, and consumer services and government services are also distinguished. The values for different countries in the same row in Table **1** are directly comparable with each other and the ratio of one to another yields a conventional volume index. For example, it can be seen that, in real terms, the per capita GDP of the United States in **1980** was over twice that of Ireland or, alternatively, that the volume of construction per head in Japan was three times larger than that in the United Kingdom.

In order to derive aggregate PPPs it is necessary to divide per capita expenditure data in national currencies by the corresponding per capita expenditure data in international dollars given in Table **1,** and the PPPs derived in this way are given in Table *2.* It should be noticed that, whereas the PPP for the United States for GDP as a whole is fixed at unity because of the choice of numeraire, the PPPs for the individual components of final expenditure in the United States do not equal unity because the pattern of relative international prices (although expressed in dollars) is not the same as the actual pattern of relative prices within the United States. Thus, the PPPs in the final column of Table 2 show the ratios of US prices to the international prices for that category of expenditure, on average. It can be seen, for example, that compared with average prices in the OECD area the prices of goods, especially consumer goods, were relatively low in the United States, whereas the prices of services, especially consumer services (which include health expenditures), were relatively high.

Before analysing patterns of relative prices, both within countries and between countries, in more detail it is worth explaining briefly how the PPPs for different categories of expenditure given in Table 2 need to be manipulated to obtain PPPs

Table 1. Real value of final expenditure and GDP per capita in 1980

In international dollars

	Belgium	Denmark	France	Germany	Greece	Ireland	Italy	Luxem-bourg	Nether-lands	Portugal	Spain	United Kingdom	Austria	Finland	Norway	Canada	Japan	United States
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Consumer goods	3397	3146	3275	3827	1873	1783	2745	3705	3312	1667	2783	2515	2838	2371	2844	3967	1764	4277
Construction	1530	1239	1399	1583	864	846	1013	1793	1151	326	882	520	1373	1552	1729	1720	1559	1215
Machinery and equipment	546	590	758	834	233	511	421	825	637	181	373	582	786	615	867	1133	1034	1055
Total goods	5426	4962	5426	6236	2933	3 142	4161	6291	5165	2184	4028	3671	4997	4539	5440	6821	4357	6547
Consumer services	2579	2638	2876	2599	1699	1952	2419	2835	2457	1218	1725	2821	2776	2267	2194	3281	3027	3140
Collective consumption of Government	1609	2432	1515	1007	740	955	1208	1521	1521	830	571	1869	1154	1685	2426	1312	1051	1885
Total services	4192	6089	4391	3600	2437	2906	3626	4357	3983	2051	2290	46981	3930	3951	4620	4593	4078	5025
Gross domestic product	9436	9831	9 780	10200	5097	5480	7 788	10626	9316	3832	6353	8253	8625	8641	11 325	11615	8414	11447

Table 2. Purchasing power parities for GDP and its components, 1980

National currencies per international dollar

	Belgium	Denmark	France	Germany	Greece	Ireland	Italy	Luxem- bourg	Nether- lands	Portugal	Spain	United Kingdom	Austria	Finland	Norway	Canada	Japan	United States
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Consumer goods	38.24	8.61	5.65	2.49	42.79	0.577	877	36.08	2.48	40.91	67.63	0.539	17.61	5.59	7.09	0.95	286	0.881
Construction	34.07	6.78	4.58	2.24	32.47	0.445	700	34.11	2.72	47.23	58.40	0.646	14.41	3.86	6.17	1.06	276	0.956
Machinery and equipment	39.78	8.36	6.13	2.57	61.36	0.691	1122	38.67	2.83	55.33	74.10	0.650	18.17	5.96	7.68	0.93	208	0.904
Total goods	37.55	8.15	5.45	2.44	41.77	0.559	863	36.04	2.57	42.88	66.38	0.564	16.82	5.05	6.89	0.97	264	0.899
Consumer services	33.80	6.91	4.92	2.32	27.69	0.370	608	29.48	2.29	23.96	59.33	0.429	12.58	3.90	5.88	1.20	222	1.143
Collective consumption of Government	38.90	6.30	5.17	2.38	35.31	0.407	690	40.17	2.80	18.58	67.61	0.383	15.30	3.99	5.39	1.36	192	1.114
Total services	35.72	6.59	5.01	2.34	30.03	0.383	635	33.20	2.48	21.75	61.55	0.410	13.37	3.94	5.63	1.25	214	1.132
Gross domestic product	36.61	7.43	5.24	2.37	35.42	0.461	759	34.59	2.53	31.66	63.65	0.487	15.39	4.52	6.16	1.08	240	1.000
Memorandum item: Exchange rates	29.20	5.64	4.23	1.82	42.60	0.487	856	29.20	1.99	50.10	71.70	0.430	12.90	4.32	4.94	1.17	227	1.000

Note The PPPs for individual categories of expenditure have been derived by dividing nominal values by the real values in table 1 The figures for the United States are generally not equal to 1 except at the level of GDP as a whole because only at the level of GDP as a whole are US expenditures in international dollars normalized to equal US expenditures in actual dollars For any detailed category of expenditure the international price in dollars is not equal to the actual dollar *price inside* the United Slates (see text)

See also the notes to table 1

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Table 3. Purchasing power parities for GDP and its components, 1980

National currencies per 1 US dollar

	Belgium	Denmark	France	Germany	Greece	Ireland	Italy	Luxem-bourg	Nether-lands	Portugal	Spain	United Kingdom	Austria	Finland	Norway	Canada	Japan	United States
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Consumer goods	43.38	9.77	6.41	2.83	48.55	0.654	995	40.93	2.81	46.41	76.73	0.611	19.98	6.35	8.05	1.07	325	1.00
Construction	35.66	7.09	4.79	2.35	33.98	0.466	733	35.69	2.84	49.42	61.11	0.676	15.08	4.04	6.45	1.11	289	1.00
Machinery and equipment	44.03	9.25	6.78	2.85	67.91	0.765	1241	42.80	3.14	61.24	82.01	0.720	20.11	6.59	8.50	1.03	231	1.00
Total goods	41.78	9.07	6.06	2.72	46.47	0.622	960	40.10	2.86	47.70	73.86	0.627	18.71	5.62	7.67	1.08	294	1.00
Consumer services	29.58	6.04	4.31	2.03	24.23	0.324	532	25.80	2.01	20.97	51.92	0.375	11.01	3.41	5.15	1.05	194	1.00
Collective consumption of Government	34.92	5.65	4.64	2.13	31.70	0.366	619	36.06	2.52	16.68	60.70	0.344	13.73	3.59	4.84	1.22	173	1.00
Total services	31.55	5.82	4.43	2.07	26.53	0.338	561	29.33	2.20	19.21	54.37	0.362	11.82	3.48	4.97	1.10	189	1.00
Gross domestic product	36.61	7.43	5.24	2.37	35.42	0.461	759	34.59	2.53	31.66	63.65	0.487	15.39	4.52	6.16	1.08	240	1.00

Note: These figures are derived from those in table 2 by dividing the figures in each row of table 2 by the figure for the United States in the same row.
See also the notes to table 1.

between a pair of countries. In order to obtain the PPP for a given category of expenditure between a given pair of countries, it is necessary simply to divide one figure by another in Table 2. For example, to obtain the PPP for goods between France and Germany it is necessary to divide 5.45 by 2.44 to obtain 2.23 French Francs per Deutschmark. Notice this applies even to the PPPs against the United States. For example, the PPP for goods between the United States and the United Kingdom is **0.99** divided by 0.564, or **1.59** dollars per pound. As there is considerable interest in the actual dollar PPPs (i.e. the PPPs based on actual US prices as distinct from average international prices expressed in dollars) these are also shown for convenience in Table 3 where the PPPs in each row of Table 2 have been divided by the US PPP in that row.

The figures in Tables 2 and 3 illustrate one of the main themes of this paper, namely, that the differences in the pattern of relative prices from one country to another are usually sufficiently great to entail different PPPs for different categories of expenditure for the same pair of countries. While a global PPP, such as that referring to GDP as a whole, may be useful for many purposes, it is an average of diverging PPPs for individual expenditure components. Even a simple split between the goods and services which make up final expenditures may reveal very different PPPs. For example, the PPP between the United States and the United Kingdom in **1980** for GDP as a whole was estimated to be 2.05 dollars per pound (the reciprocal of the PPP shown in Table **3).** However, while the PPP for goods was **1.59** dollars per pound as already noted, that for services was 2.76 dollars per pound, or nearly 75% larger. This reflects the fact that the ratios of the prices of most services to the prices of most goods were distinctly higher on average in the United States than in the United Kingdom. From the point of view of foreign trade, one PPP of particular interest is that for tradeable goods. It should be noted, however, that while the PPPs for goods shown in Table 2 or 3 yield much closer approximations to those for tradeable goods than global PPPs referring to GDP, the approximations are still far from perfect. In order to move from final goods, as shown here, to tradeable goods, it is necessary to exclude construction and to include intermediate goods and raw materials. Such adjustments might modify the PPPs significantly, but the requisite data are not available and the calculations have not been carried out here.

III.   PATTERNS OF RELATIVE PRICES IN OECD COUNTRIES

The pattern of average international prices which underlies the figures in Table 2 can be used as the reference, or standard, with which to compare actual prices within an individual country. By dividing the PPPs for individual categories of

	Belgium	Denmark	France	Germany	Greece	Ireland	Italy	Luxem-bourg	Nether-lands	Portugal	Spain	United Kingdom	Austria	Finland	Norway	Canada	Japan	United States
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Consumer goods	104	116	108	105	121	125	116	104	98	129	106	111	114	124	115	87	119	88
Construction	93	91	87	95	92	96	92	99	107	149	92	133	94	85	100	98	115	96
Machineryandequipment	109	113	117	109	173	150	148	112	112	175	116	134	118	132	125	86	87	90
Total goods	103	110	104	103	118	121	114	104	102	135	104	116	109	112	112	90	110	90
Consumer services	92	93	94	98	78	80	80	85	91	76	93	88	82	86	96	111	92	114
Collective consumption of Government	106	85	99	100	100	88	91	116	111	59	106	79	99	88	88	126	80	111
Total services	98	89	96	99	85	83	84	96	98	69	97	84	87	87	91	115	89	113
Gross domestic product	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Note   This table is derived from table 2 by dividing the PPP for each component of final expenditure in a given country by the PPP for GDP in that country
See also the notes to table 1

expenditure in each column of Table 2 by the overall PPP for GDP for that country, indices are obtained which show the average ratios of the national to the international prices, for the various expenditure components. The resulting indices are shown in Table 4. Although the data are highly aggregated it can be seen from the table that not only does the pattern of relative prices vary significantly from country to country it also tends to vary systematically with the level of real per capita GDP. This can be shown most easily by calculating the regressions of the relative price indices for the various categories of expenditure on real per capita GDP, which are given in Table 5.

Table 5.   Regressions of relative Price Indices
on Real Per Capita GDP: 1980

Real per capita GDP in thousands of dollars

Relative price of	Estimated coefficients (Standard errors)		r^2
	Constant	Slope	
Consumer goods	143.6 (8.6)	−3.8 (1.0)	0.49
Construction	125.6 (15.5)	−2.8 (1.7)	0.14
Machinery and equipment	205.4 (15.8)	−9.5 (1.8)	0.65
Total goods	142.4 (6.5)	−3.9 (0.7)	0.64
Consumer services	58.9 (6.7)	3.6 (0.8)	0.59
Collective consumption of Government	61.0 (13.4)	4.0 (1.5)	0.31
Total services	59.4 (7.3)	3.8 (0.8)	0.58

These results indicate that the prices of services tend to increase relatively to the prices of goods as the level of per capita GDP rises. In order to illustrate the magnitude of this effect, it is useful to examine the expected values of the relative price indices for goods and services corresponding to selected values of real per capita GDP. The expected values from the underlying regression equations are as follows.

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Real per capita GDP (in 1980 dollars)	4000	6000	8000	10000	12000
Expected relative price index for goods	127	119	112	104	96
Expected relative price index for services	74	82	89	**97**	104

The fact that these indices tend to be close to 100 for a country with a per capita GDP of around 11 000 dollars (in 1980) simply reflects the fact that the underlying average international prices which are being used as the reference base are heavily influenced by the prices of the larger and richer countries, such as the United States and Germany. In general, the results show that quite significant shifts in relative prices may be expected in moving from countries with relatively low to relatively high levels of real per capita GDP, even within a fairly homogenous group of countries such as the OECD. For example, in moving from a country with a real per capita GDP such as Portugal's to one with the level of income of the United States the prices of services may be expected to be roughly 80 per cent higher on average relative to the prices of goods, according to the above results.

The phenomenon that services are relatively more expensive in rich countries has been observed before. However, previous results have tended to lean heavily on comparisons between extremes — between countries like the United States on the one hand and the poorest developing countries of Asia, Africa or Latin America on the other hand. The present results show that the relationship holds up remarkably well even for a much more homogeneous group of countries such as OECD countries for whom the range of variation of real per capita GDP is much smaller.

One explanation for the phenomenon which seems to command fairly widespread support is that given by Kravis, Heston and Summers (1982, p. 21) which is also quoted by Bhagwati (1984, p. 279).

"As a first approximation it may be assumed for purposes of explaining the model that the prices of traded goods, mainly commodities, are the same in different countries. With similar prices for traded goods in all countries, wages in the industries producing traded goods will differ from country to country according to differences in productivity — a standard conclusion of Ricardian trade theory. In each country the wage level established in the traded goods industries will determine wages in the industries producing nontraded goods, mainly services. Because international productivity differences are smaller for such industries, the low wages established in poor countries in the low-productivity traded goods industries will

apply also to the not-so-low productivity service and other nontraded goods industries. The consequences will be low prices in low-income countries for services and other nontraded goods."

This explanation is elaborated and developed somewhat in a later paper by Kravis and Lipsey (1983) who point out that earlier versions are to be found in Harrod (1933, chap. IV), Balassa (1964) and Samuelson (1964). They also point out that the ideas involved can be traced back to Ricardo. More recent papers which examine the relationship between the relative prices of goods and services and per capita GDP are those by Samuelson (1984), Bhagwati (1984), Kravis (1984) and Marris (1984). Marris develops the argument summarised above by emphasising that tradeability hinges essentially on transport costs and that the transport costs associated with service transactions between residents and non-residents are usually extremely high. One of the economically significant characteristics of most service activities is that producer and consumer must come into direct contact with each other at the time production takes place [see Hill (1977)]. Sometimes the producer travels to the consumer, but much more often the consumer has to travel to the producer's place of work, as in the case of services such as health, education, entertainment, automobile repairs, and many others. There is nothing to prevent international transactions between residents and non-residents for most services, but the transport costs are usually very high for one or the other party to the transaction.

Bhagwati (1984, p. 281) seeks to move beyond an argument based on "the excessively limiting Ricardian framework of a single factor, labour" to one based on "general equilibrium analysis as practised by international trade theorists" (ibid). Bhagwati's argument does, however, assume that the countries compared are economically very different from each other, i.e. that "their comparative factor endownments are sufficiently apart so as not to permit them to be at the same wage-rental ratio and hence to be in the same (McKenzie-Chipman) diversification cone. If therefore two countries or groups of countries are close together, in GPD per capita, we would expect the several correlative phenomena explained in this paper would also be correspondingly weak." (Bhagwati, 1984, p. 285). The OECD results, however, suggest extremely different resource endowments may not be necessary: thus, services in the United States and Canada are relatively more expensive than in countries such as Germany or France with only slightly lower real per capita GDP's, while services in Germany and France are, in turn, relatively more expensive than in countries such as Italy and Greece which are not so much further down the income scale.

Of course, the relationships between the relative prices of goods and services for OECD countries are by no means exact and there are some interesting

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divergencies to be observed. For example, on the basis of the cross-section relationships considered here, the prices of services seem unusually high in Spain while the prices of goods seem unusually high in Norway. The prices of consumer goods (but not machinery and equipment goods) are unusually high in Japan; and *so* on. Finally, **it** may be noted that the prices of services in the United States and Canada are not only relatively high compared with other countries (as would be expected from their high per capita GDPs), they are even higher than would be predicted on the basis of the cross-section relationships considered here.

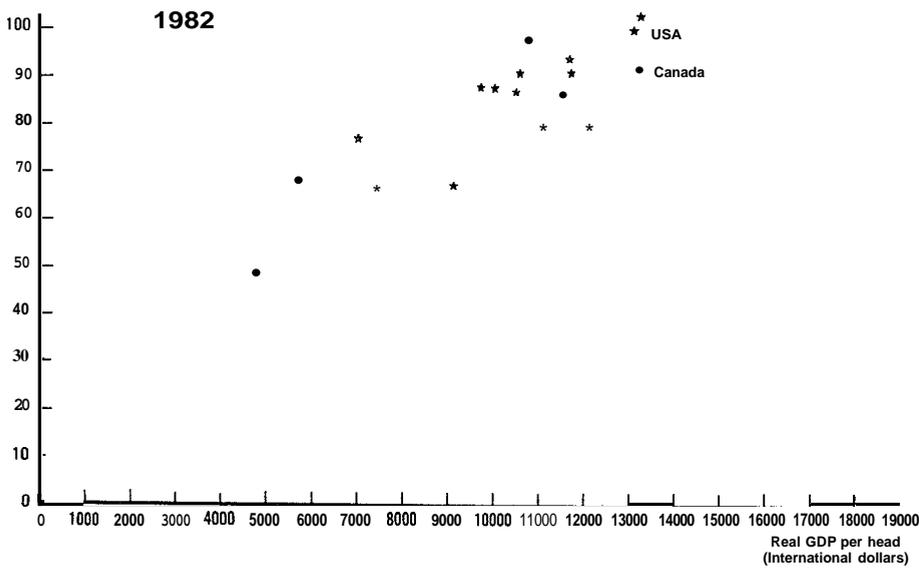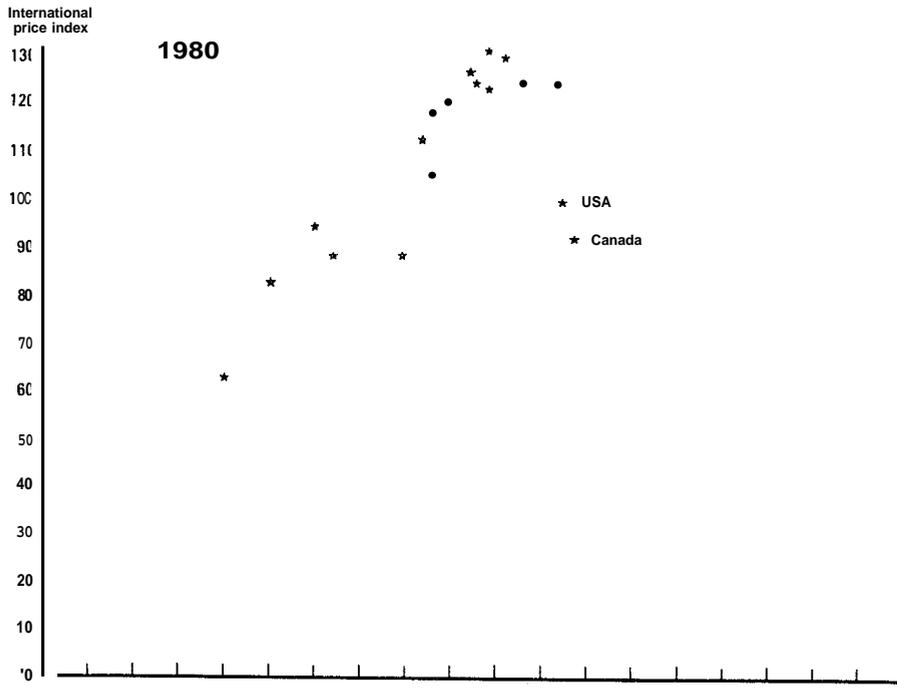## IV. COMPARATIVE PRICE LEVELS AND REAL PER CAPITA GDP

Table 6 shows the international price indices based on the USA index equal one hundred for the same groups of goods and services. As explained earlier, these are the indices which are obtained when the prices in each country are converted into a common currency (here the US dollar) using market exchange rates for the purpose. At any given moment of time the cost of purchasing a given commodity in one country rather than another (abstracting from transport costs) is determined by the price of that commodity within each of the two countries concerned and the exchange rate between their currencies. Thus, in principle, the international price indices show the relative costs of purchasing the same bundle of goods and services in different countries when the funds used to make the purchases are shifted from one country to another at the going market exchange rates. In practice, the international price indices shown here are obtained by dividing the PPPs by the exchange rates: in other words, the conversion of the prices into a common currency is made after the price index is calculated, but **it** is immaterial whether the currency conversion is made before or after the basic price observations are processed.

It should be noted that the indices in Table 6, like the corresponding PPPs, are **multilateral** indices which treat all countries symmetrically. Although the United States is used as the reference country for the international price indices, no special significance is attached to US prices or expenditures as the underlying methodology assigns equal weight to prices and transactions wherever they occur in the group of countries included in the sample.

International price indices can be calculated for any specified set of goods and services, *so* that each category of expenditure shown in Table 6 has its own separate price index. The index with the widest coverage is, of course, that for GDP as a whole, and it is convenient to examine this index first. As can be seen from Table 6 the five countries with the lowest levels of real per capita GDP – Portugal,

	Belgium	Denmark	France	Germany	Greece	Ireland	Italy	Luxem-bourg	Nether-lands	Portugal	Spain	United Kingdom	Austria	Finland	Norway	Canada	Japan	United States
Consumer goods	149	173	152	155	114	134	116	140	141	93	107	142	155	147	163	92	143	100
Construction	122	126	113	129	80	96	86	122	143	99	85	157	117	94	131	95	127	100
Machinery and equipment	151	164	160	157	159	157	145	147	158	122	114	167	156	153	172	88	102	100
Total goods	143	161	143	149	109	128	112	137	144	95	103	146	145	130	155	92	129	100
Consumer services	101	107	102	111	57	67	62	88	101	42	72	87	85	79	104	90	86	100
Collective consumption of Government	120	100	110	117	74	75	72	123	127	33	85	80	106	83	98	105	76	100
Total services	108	103	105	114	62	69	66	100	110	38	76	84	92	81	101	94	83	100
Grossdomestic product	125	132	124	130	83	95	89	118	127	63	89	113	119	105	125	93	106	100

INTERNATIONAL PRICE INDICES
AND REAL GDP PER HEAD

International price index

1980

- 130
- 120
- 110
- 100
- 90
- 80
- 70
- 60
- 50
- 40
- 30
- 20
- 10
- 0

★ USA

★ Canada

1982

- 100
- 90
- 80
- 70
- 60
- 50
- 40
- 30
- 20
- 10
- 0

★ USA

● Canada

0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000 12000 13000 14000 15000 16000 17000 18000 19000

**Real GDP per head
(International dollars)**

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Greece, Ireland, Spain and Italy — all had low international price indices in 1980 but the situation is more diverse for countries with high levels of real per capita GDP because the indices for the United States and Canada were actually much lower than those for a number of other QECD countries with lower levels of real per capita GPD. This can be seen more clearly in the Diagram.

Nineteen-eighty, the year selected for the Eurostat/OECD PPP enquiry, happens also to have been the year in which the US dollar touched its lowest point against most other currencies on the foreign exchange markets. The dollar depreciated by around 40 per cent against some of the stronger European currencies between 1971 and 1980, while it rebounded in the course of the following five years by roughly doubling its value against some of the same currencies . For these reasons, the general level of US prices, when compared with prices in most other countries expressed in dollars at current exchange rates, also reached a low point in 1980. From this point of view, 1980 is clearly an atypical year for comparisons with the United States and this needs to be borne in mind when interpreting the data in Table 6.

It can be seen from the Diagram that, excluding the United States and Canada, there was a fairly strong association between price level and real per capita GDP in 1980. In fact, the United States and Canada represented outliers, which deviated considerably from the fairly tight relationship observed for the other 16 countries. This is confirmed by calculating the correlation coefficients between price level and real per capita GDP both including and excluding the United States and Canada. The squared correlation coefficient (r^2) for all 18 countries equals 0.47, but after excluding the United States and Canada it rises to 0.86. This is quite a high correlation for a cross-section relationship. The very high correlation obtained when the United States and Canada are omitted demonstrates another important point, namely that the observed relationship is not a phenomenon which crucially depends on the level of US prices or the dollar exchange rate. On the contrary, the inclusion of the United States (and Canada) in 1980 weakens an otherwise strong cross-section relationship.

It is to be expected, therefore, that the subsequent appreciation of the dollar would tend to improve the correlation for all 18 countries, and this is indeed the case. The relevant correlations, and accompanying regressions, are given in Table 7. As explained earlier, the PPPs and associated international price indices for years subsequent to 1980 were obtained by adjusting the 1980 bench-mark PPPs to take account of the differential rates of inflation from 1980 onwards in the countries concerned [see Ward (1985) for further details]. It can be seen from Table 7 that there was a significant increase in r^2 for all 18 countries between 1980 and 1982/83, by which time it also made almost no difference whatsoever to the

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	Excluding the United States and Canada			Including the United States and Canada		
	Constant	Slope	r^2	Constant	Slope	r^2
1980	32.8 (8.6)	9.2 (1.0)	0.86	54.4 (14.9)	6.2 (1.7)	0.47
1981	32.3 (8.1)	6.5 (0.9)	0.80	43.1 19.1)	5.1 (0.9)	0.65
1982	34.1 (9.1)	4.8 (0.9)	0.67	35.0 (8.1)	4.7 (0.8)	0.70
1983	27.4 (8.7)	4.5 (0.8)	0.69	25.1 (7.9)	4.8 (0.7)	0.74
1984	26.8 (8.6)	3.7 (0.7)	0.64	22.5 (8.2)	4.2 (0.7)	0.70

regression line whether the United States and Canada were included or excluded from the relationship.

As the dollar appreciated from 1980 onwards, the percentage point deviation of the United States international price index from the regression lines for all 18 countries increased algebraically from one year to the next as follows:

1980	1981	1982	1983	1984
−25.6	−8.2	3.1	7.8	12.8

These are the deviations from the regression lines shown in the right half of Table 7. In 1980, however, the inclusion of the United States and Canada actually tilted the regression line downwards significantly: if the deviation is calculated between the actual index for the United States and that predicted by the regression line for the other 16 countries (excluding the United States and Canada) the 1980 deviation increases to −38.6. As the inclusion of the United States and Canada appears to distort the cross-section relationship for that year, it can be argued that the deviation from the regression line for the 16 countries gives a better measure of the extent to

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which US prices were lower than expected in **1980,** the actual level **(100)** being only **72** per cent of the predicted level **(138.6).** Thus, it can be argued that US prices, increased from being **28** per cent lower than expected in **1980** to being about **15** per cent higher than expected in **1984** (the actual index **100** being 1**5** per cent higher than the expected index of **87.2).** The year **1982** is the one in which the actual US price index was closest to that predicted by the international cross section regression (for all **18** countries). Thus, **1982** appears to be the year in which the **US** price level was more or less consistent with expectations based on these cross-section relationships. This would suggest, for example that it would probably be the most suitable recent year to serve as a base year for the calculation of movements in real dollar exchange rates.

The relationship between aggregate international price levels and real per capita **GDP** examined above is a direct consequence of that between the relative prices of goods and services and real per capita **GDP** considered in the previous section. The relationship has been observed for other groups of countries in earlier periods of time and theoretical explanations for it have been advanced in the literature already cited, in particular the papers by Kravis and Lipsey **(1983)** and Marris **(1984).** Thus, the **OECD** results presented here provide additional evidence for the existence of a very pervasive and very persistent empirical relationship between national price levels and real per capita **GDP.** Three points are worth mentioning: First, the present study shows the relationship does not depend on extreme comparisons between rich developed countries and poor developing countries in Asia, Africa or elsewhere. Second, it does not depend critically on the inclusion of the United States or the behaviour of the dollar exchange rate. Third, the relationship has proved to be remarkably robust in the presence of differential rates of inflation and fluctuating exchange rates over the last decade or so.

The standard explanation for the relationship between the national price level and real per capita **GDP** is a simple extension of that already advanced for the differential between the prices of goods and services. Suppose the "law of one price" holds to the extent that the prices *of* traded goods tend to be similar in all countries, then the prices of services will tend to vary directly with the level of real per capita **GDP** so that the average price level will also tend to vary with real per capita **GDP,** though to a lesser extent than that for services alone. It should be remembered, however, that the distinction between traded and non-traded goods cannot be equated with that between goods and services used here. A large part of foreign trade consists of intermediate goods and raw materials which do not appear directly in final expenditure data. In addition, the prices paid by purchasers for consumer or capital goods normally include substantial margins to cover domestic trade and transport, and possibly other related services. Indeed, the purchasers'

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Table 8. Regressions of International Price Indices on Real Per Capita GDP

International price indices based on USA= 100:
Real per capita GDP in thousands of dollars

Estimated coefficients
(standard errors)

	Excluding the United States and Canada			Including the United States and Canada		
	Constant	Slope	r^2	Constant	Slope	r^2
Goods						
1980	65.6 (10.4)	6.6 (1.2)	0.68	93.4 (18.8)	2.8 (2.1)	0.10
1981	52.1 (13.9)	5.5 (1.5)	0.54	80.1 (16.9)	2.1 (1.7)	0.10
1982	50.4 (13.1)	4.1 (1.3)	0.46	64.0 (13.6)	2.6 (1.3)	0.22
1983	42.3 (12.6)	3.9 (1.1)	0.55	54.5 (12.9)	2.7 (1.1)	0.34
Services						
1980	8.8 (11.7)	10.8 (1.4)	0.82	20.3 (12.2)	9.1 (1.3)	0.74
1981	23.4 (8.6)	6.7 (0.9)	0.82	23.0 (7.1)	6.8 (0.7)	0.86
1982	26.2 (7.4)	5.1 (0.7)	0.80	14.2 (9.7)	6.5 (0.9)	0.78
1983	21.5 (8.9)	4.7 (0.8)	0.78	−0.7 (15.5)	7.0 (1.3)	0.70
GDP						
1980	32.8 (8.6)	9.2 (1.0)	0.86	54.4 (14.9)	6.2 (1.7)	0.47
1981	34.7 (10.1)	6.3 (1.1)	0.75	50.7 (11.1)	4.4 (1.1)	0.53
1982	38.3 (9.9)	4.6 (1.0)	0.65	40.1 (8.6)	4.4 (0.8)	0.67
1983	33.2 (10.0)	4.2 (0.9)	0.69	29.8 (8.9)	4.5 (0.8)	0.75

Note: The requisite price indices to update the 1980 PPPs for goods and services separately are not available for all countries. For this reason, the number of countries covered falls from 18 in 1980 to 14 in 1983 *so* that the GDP regressions for the years 1981-83 are not identical with those in Table 7 which cover all 18 countries in every year.

price is often a composite price covering a package of goods and services e.g. the prices paid for medical treatments, meals or hotel rooms. For these kinds of reasons, the distinction made here between goods and services tends to cut across that between traded and non-traded goods. Thus, even if the "law of one price" were to hold for goods actually traded, it could only be expected to hold in an attentuated form for the prices actually paid for most final goods.

The OECD data support the hypothesis sketched above. Table **8** shows the regressions of the international price indices for goods and services separately as functions of real per capita GDP. The correlations for services are consistently stronger than those for goods, while the regression lines for services are also consistently steeper. In **1980** and **1981,** the results for all **18** countries, including the United States and Canada, show virtually no correlation between goods' prices and real per capita GDP and a strong correlation between services' prices and real per capita GDP. This is, of course, precisely the result to be expected if the "law of one price" operated for goods but not for services. As suggested earlier, however, perhaps not too much weight should be given to the **1980** results including the United States and Canada because of the exceptionally low value of the dollar in that year. By **1982** and **1983** the correlations for goods had increased somewhat and become statistically significant, but those for services remained substantially stronger, especially in **1982.** Another interesting feature of the services regressions is that in **1982** and **1983** the constant terms were not significantly different from zero, so that variations in services' prices were roughly proportional to those in real per capita GDP. In general, therefore, it can be concluded that the OECD results lend a great deal of support to the explanations outlined above for the persistently observed relationship between national price levels and real per capita GDP.

V. PRICE LEVELS, PURCHASING POWER PARITIES AND EXCHANGE RATES

The relationships considered in the previous sections imply that the so-called "law of one price" does not hold for final domestic expenditures. There is no tendency for the prices of the goods and services which enter into final demand, expressed in a common currency by means of exchange rates, to be equal. Or, to put the same point in a different way, there is no systematic tendency for exchange rates to equal the PPPs for final expenditures. In general, for any given pair of countries the probability of the exchange rate deviating from the corresponding GDP PPP increases as the gap between their real per capita GDPs widens: when the gap is

substantial the price level may be confidently expected to be higher in the richer of the two countries.

It should be noted that this is obviously a generalisation about pairs of countries and not about individual countries. It can be highly misleading to make statements about the relationship between the exchange rate and the PPP for an individual country, or a particular type of country, when such statements always require an assumption, explicit or implicit, about the partner country or countries involved. A few examples may help to clarify the point.

The following table shows the exchange rates and estimated GDP PPPs for selected pairs of OECD countries in 1983.

Table 9. **PPPs and Exchange Rates for Selected Pairs of Countries in 1983**

	GDP PPP (1)	Exchange rate (2)	(1)/(2) (GDP price index)
United States - Canada	1.14	1.23	93
France - Germany	0.367	0.335	110
Greece - Spain	1.44	1.63	88
France - Spain	12.7	18.8	68
Germany - Greece	24.0	34.5	70
United States - Spain	75.5	143.4	53

If we take pairs of countries whose real per capita GDPs are not very different, such as France and Germany, the United States and Canada or Greece and Spain, the exchange rates are also not very different from the GPD PPPs — within a margin of about 10 per cent or so. If, however, the pairings are switched so that France is paired with Spain, Germany with Greece and the United States with Spain, considerable divergences emerge between the exchange rates and the PPPs — the price level in the country with the lower real per capita GDP being only half to two-thirds of that in the other country. These results illustrate the fact that divergences between exchange rates and PPPs are not characteristic of countries with relatively high or low real per capita GDPs as such but of pairs of countries in which a country with a relatively high per capita GDP is combined with one with a relatively low per capita GDP.

When presenting information on PPPs or on price levels it is customary to take the United States as the reference country for the comparisons because of its large size, its high level of real per capita GDP and the widespread interest in the dollar

exchange rate. This convention automatically fixes the PPP for the United States equal to the dollar exchange rate, while at the same time ensuring that the divergence between the PPP and the exchange rate will be greatest for those countries whose per capita real GDPs differ most from the United States − i.e. the poorest countries. This easily leads to loose statements to the effect that the gap between the PPP and the exchange rate is widest for countries with the lowest levels of real per capita GDP. Such statements can be misleading and sometimes plain wrong. Thus, it is not an inherent characteristic of poor countries that their exchange rates differ widely from their PPPs: there is no evidence for this when they are compared among themselves. Gaps open up only in the special circumstances in which relatively poor countries are compared collectively with a very rich country, such as the United States, *and* when the latter is also taken as the reference country. Thus, in an OECD context, if a country such as Portugal or Greece were to be chosen as the reference country instead, the situation would be reversed with the gaps between the PPPs and exchange rates widest for the group of countries with the highest levels of real per capita GDP, especially the United States.

While not wishing to labour this point, it should be noted that similar misunderstandings can arise concerning the relationship between nominal per capita GDPs based on exchange rates and real per capita GDPs based on PPPs. When the United States is taken as the reference country, nominal and real per capita GDPs are automatically identical, with the gap between nominal and real per capita GDP tending to be greatest for the countries with the lowest levels of real per capita GDP. At a world level strong criticism has been levelled at the United Nations International Comparison Project [Kravis, Heston and Summers (1982)] because some observers have concluded that the results imply that the per capita GDPs of the poorest developing countries have been grossly underestimated in some sense, a conclusion which is very unpopular with some of the countries concerned. Of course, the ICP results do not imply any such thing, but the mere fact that such serious misunderstandings can arise underlines the importance of the point made here.

Given that one country has to be used as the reference country, and that most users seem to prefer the United States, it is worth concluding this section by examining how large the differences in price levels to be found between other OECD countries and the United States are. For this purpose, it is proposed to take the expected price indices based on the regressions in Table 7, using the regression for 16 countries in 1980 and the regressions for all 18 countries in subsequent years. Only a subset of countries is shown in order to give an impression of the orders of magnitude involved. The expected values of the international price indices have been scaled in each year in order to have the expected value for the United States equal to 100.

Table 10. **Expected international price indices**

Based on the USA = 100

	Portugal	Greece	Spain	Italy	UK	Japan	France	Germany	United States
1980 regression (16 countries)	50	57	66	76	79	81	89	91	100
1981 regression	60	65	72	80	82	85	90	92	100
1982 regression	59	64	72	81	84	87	92	93	100
1983 regression	53	58	68	77	82	86	90	92	100
1984 regression	50	56	66	74	79	85	87	90	100

Although the coefficients of the regression equations given in Table 7 vary in response to the changes in the levels of real per capita GDP expressed in current dollars, the relationships between the expected price indices implied by these equations are very stable. In particular, the relationships implied by the regression for all 18 countries in 1984 are very close to those based on the 16 country regression for 1980.

The interpretation of the results in Table 10 is straightforward. For a country such as Portugal, whose real per capita GDP of 1984 was about one third of that of the United States, the price level can be expected to be about a half, or just over a half of that of the United States. For a country such as Spain whose real per capita GDP was around 55 per cent of the United States, the expected price level is about two-thirds. For a country such as France or Japan with a real per capita GDP around 80 per cent of the United States, the expected price level is 10 or 15 per cent below that of the United States.

The above percentages also provide the adjustment factors needed if the exchange rate has to be inferred from the GDP PPP. When the country with the highest level of real per capita GDP is taken as the reference country, the PPPs always need to be adjusted upwards by varying amounts depending upon the level of the real per capita GDP of the country examined. For example, for a country at the level of real per capita GDP of France, the GDP PPP with the United States needs to be increased by around 15 per cent. For a country at the real per capita output level of Spain, it needs to be increased by around 50 per cent, etc.

The above relationships have not been formulated in a very systematic way in order to avoid creating the impression that tight links exist between PPPs and exchange rates. Exchange rates obviously depend on whole range of other factors not taken into consideration here *so* that any relationship between PPPs and exchange rates has inevitably to be a loose one. In any case, the estimated PPPs for

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the most recent years may have to be revised in due course and some of the data underlying the relationships may not be as reliable as would be desired. The information obtained from the 1980 benchmark PPP enquiry has been stretched to the limit in this paper, and, as already mentioned, it may be prudent to await the results of the major new Eurostat/OECD survey for 1985 before pushing the analysis further.

CONCLUSIONS

Data derived from the 1980 OECD PPP project indicate the existence of some major differences in the price levels of final expenditures between OECD countries when national prices are converted into a common currency at market exchange rates. National price levels tend to increase with the level of real per capita GDP *so* that the differences are greatest between countries at either end of the income scale. These results corroborate similar results obtained for other groups of countries and periods and suggest that the relationship between price level and real per capita GDP is a general one which is remarkably resilient, even in the presence of differing rates of inflation and fluctuating exchange rates.

The existence of these price level differences implies that when expenditure or output data for different countries are converted into a common currency by means of exchange rates, the ensuing differences in widely used comparative statistics such as per capita GDP are liable to reflect differences in price levels as much as differences in volumes. For this reason, data converted at exchange rates cannot be interpreted as if they measured real differences only, and it is necessary to use the price data collected in the PPP enquiries to calculate constant price data across countries if genuine volume comparisons are desired. One of the principal reasons for engaging in the PPP project was to make it possible to calculate such volume measures in order to be able to compare productivity levels or living standards between countries. There is now overwhelming evidence to demonstrate that exchange rate converted data should not be used for purposes of volume comparisons despite the fact that they continue to be *so* used by many authorities.

There are also important differences in the patterns of relative prices between countries and the high price levels observed in high income countries are linked to the fact that services, including government services, are relatively more expensive in those countries. The level of service prices tends to be strongly correlated with real per capita GDP, varying more or less in proportion to real per capita GDP whereas the

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corresponding correlation for goods prices tends to be much weaker. It is to be expected that the prices of goods would tend to vary less between countries, as goods are generally more easily traded than services.

The existence of important differences in price levels between countries is a reflection of the fact that, in general, **PPPs** for final expenditures are not equal to exchange rates. Moreover, the differences are not to be treated as temporary aberrations: on the contrary, the differences are persistent and pervasive. The empirical relationship between the **PPPs** for GDP and exchange rates is quite simple, namely that for any given pair of countries, the probability of the exchange rate deviating from the **PPP** increases sharply with the difference between their real per capita **GDPs.** If the countries have similar per capita **GDPs,** the exchange rate tends to be close to the **PPP,** but for pairs of OECD countries such as Germany and Greece, or the United States and Portugal, the **PPPs** and exchange rates are likely to diverge substantially.

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